METHOD AND APPARATUS FOR CREATING TEXTURED HANDLE PACKAGING

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method for designing a container, and more particularly to a container comprising a handle and a sidewall, the handle creating a hole between itself and the sidewall of the container. The invention relates even more particularly to a container having a three-dimensional image applied on the handle and sidewall of the container.

Description of the Related Art

Blow-molded plastic containers have become commonplace in packaging products using hot-fill and cold-fill processes such as beverages including juice, for example. Such a container normally has a dome, an annular sidewall extending from a base, and a waist connecting the dome to the sidewall. Typically, the containers have a horizontal cross section which is substantially circular or rectangular or is multi-faceted. Blow-molded plastic containers can provide a package with sufficient flexure to compensate for pressure and temperature, while maintaining structural integrity and aesthetic appearance. In addition, the plastic used in the containers is recyclable. In order to increase the sales of beverages or other products, there is a need to produce aesthetically appealing containers.

Other containers, particularly those designed for larger volumes of liquids, can have a more substantially rectangular cross-section. Such containers frequently have a handle molded into the container to make it easier to lift and to pour the contents from the container. These containers are also generally blow-molded by, for example, stretch blow-molding, extrusion blow-molding, and injection blow-molding. It is often desirable to place designs or a relief on a container for either functional reasons, such as to improve gripability, or ornamental reasons, for example by placement of a logo or some other means that promotes "brand identity."

Making molds that create relief structures on containers is known. However, conventional mold-making and design methods are limited by how the designs are created and the intricacies of the mold-making process. Generally, these

conventional methods have limited the scope of designs that can be created and the placement of designs. As a result of these limitations, designs are generally placed in relatively open spaces on a container. As used herein, an "open" space is one that readily accessible and can be on an outer tubular surface. These open spaces can be, for example, on the dome or sidewall of a round container or a flat surface of a rectangular container.

An example of a typical conventional method is a means for making a mold to create a sculpture to appear on a container. As shown in Figure 1, a design is placed on an electrode attached to a rod. The electrode 1, heated with an electric current, is applied to a mold to leave a negative relief impression of the design on the mold. Thereafter, the mold is assembled to form a mold cavity. This method is useful for placing designs on a container dome or flat, open surface of a rectangular container. One drawback of this technique is that it can result in formation of a defective sculpture by misapplication of the electrode 1 to the mold. For example, the electrode 1 may be impressed too far against the mold leaving unwanted marks on the mold, which appear on the container, or the electrode 1 may not be pressed far enough against the mold leaving a poor impression of the design on the container. As the number of desired sculptures on a container increases, the number of possible sculptural defects increases. Since both defects occur due to variances in machine tolerances during the process of impressing the conventional electrode onto the mold, there is a need for a new method for creating sculptures on containers efficiently, quickly, repeatedly, at a low cost, and with a minimum of defects.

BRIEF SUMMARY OF THE INVENTION

The above-mentioned shortcomings are overcome by a method in a computer system for generating an image for producing an electrode as disclosed in co-pending U.S. Patent Application No. 60/384,166 to Yourist filed May 31, 2002, which is incorporated herein by reference in its entirety. As disclosed therein, such a method may comprise the steps of generating a virtual sculptural relief; projecting the virtual sculptural relief onto a virtual mold cavity surface to form a virtual sculptural relief on the virtual mold cavity surface, the projected virtual sculptural relief having a profile; removing the virtual mold cavity surface outside the profile of the virtual

projected sculptural relief; extending the virtual projected sculptural relief profile to a predetermined plane to form a virtual extension of the virtual projected sculptural relief; and combining the virtual projected sculptural relief with the virtual extension, which together form a virtual image of the electrode. The virtual image is converted into a numerical control language and a material is machined, based on the numerical control language, to form an electrode. The electrode is then used to impress a mold. While such a method is useful and precise, it is still limited to placing designs on open portions of the mold.

While the above-mentioned co-pending U.S. Patent Application overcomes several of the shortcomings discussed above, the method disclosed therein does not attempt to meet the challenge of applying a three-dimensional textured image to more intricate non-open areas of a container, for example the handle and sidewall, particularly when the handle forms a hole between itself and the sidewall of the container. Therefore, among other advantages, such a method would provide a container with a better grip for the user as well as enhancing the appearance of the container compared to conventional containers. It would be aesthetically and ergonomically advantageous if there existed a method and a device for applying a three-dimensional textured image to less open areas. A particular area would be, for example, the handle and sidewall of a container when the handle forms a hole between itself and the sidewall of the container. Challenges arise in such situations because the handle and sidewall of the container are offset angularly with respect to one another, thereby making the design and application of a textured image extremely time-consuming, expensive, and inefficient using existing techniques. What is needed, therefore, is a method and a device for designing and applying a three-dimensional textured image to more than one surface of a container when the surfaces are angularly offset from one another.

An exemplary embodiment of the present invention provides the above-mentioned and other advantages through the provision of a method and device for providing a container comprising a handle and a sidewall, a three-dimensional sculptural image being applied on the handle and sidewall. The

container may be a beverage container, for example, and the three-dimensional image may be in the form of a leaf of a fruit tree, for example. The handle may form a hole between itself and the sidewall of the container. According to an exemplary embodiment of the present invention, the above-mentioned advantages are met through the provision of a method for designing a three-dimensional textured image for being applied to more than one surface of a container when the surfaces are angularly offset from one another. The image may be projected onto the handle at an oblique angle. The angle at which the image is applied may be such that the image is applied to multiple surfaces of the handle and the sidewall of the container simultaneously.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a rod attached to an electrode created in accordance with the prior art;

FIG. 2A shows an exemplary non-round container;

FIG. 2B shows an exemplary cylindrical container;

FIG. 3 is an example of a workstation utilized to implement the present invention;

FIG. 4 is a flow chart showing a method of the present invention according to an exemplary embodiment thereof;

FIG. 5 is an exemplary two-dimensional, flat image to appear on the container;

FIGS. 6-9 are exemplary three-dimensional sculptural reliefs formed from the two-dimensional, flat image shown in FIG. 5;

FIGS 10-14 illustrate the sculptural image of FIGS. 6-9 projected onto a container and being manipulated to fit the container surface;

FIGS 15-17 show the simulated mold cavity surface outside boundary of the projected sculptural relief being trimmed away; and

FIG. 18 shows a container comprising a handle and a sidewall having a three-dimensional textured image applied thereon according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A computer system can be used to design a relief, a container, or place a relief design on a container. In a typical use of such systems, a design is placed on a container in an open region of the container. Figure 2A shows an exemplary non-round container 200. Open areas in such a container include the relatively open sidewall 202, endwall 204, and dome 206 regions. In a cylindrical container, as shown in Figure 2B, open areas include the dome 208 and sidewall 210 regions. Designing a container with a relief in non-open regions of the container is more difficult than placing a relief on an open region. As used herein, non-open regions are those that have multiple surfaces meeting at a variety of angles. With reference to Figure 2A, non-open regions include, for example, the handle 212, interior handle surface 214, and the container wall underlying the handle 216.

Forming a continuous design on such a surface using conventional techniques, if possible at all, is difficult. Preparing a mold for such a container using conventional techniques would require burning the design into a mold using multiple electrodes that approach at multiple angles including, for example, an oblique angle (i.e., an angle other than a right angle). Aligning such multiple electrodes to prepare a continuous design using such conventional techniques is a tedious and time-consuming task. For example, failure to properly align the electrodes would result in unacceptable design incontinuities. Alternatively, such molds could be hand-tooled. This, however, adds undesirable time and expense to the mold-making process. The present invention uses design software and automated tooling software to (a) generate a design, and (b) make a mold from the design. Further, according to an exemplary embodiment of the present invention, when projecting an image on the virtual surface of the container, there may be some distortion in the projected image. According to an exemplary embodiment of the present invention, the projected image may be corrected (for example, by modifying the boundary of the projected image by drawing 3-D bspline curves), flattened (projected) to a plane in virtual space, the image may be used to form a new virtual sculptural relief, and the new virtual sculptural relief may be reprojected onto the virtual container surface to form a new virtual projected sculptural relief to obtain the design of the container.

Figure 3 shows a block diagram of a workstation 20 coupled to a network 10, which provides an example of a computer system, that may be used to implement the invention. The network 10 and the components interfacing with the network are optional parts of the computer system. Workstation 20 includes one or more processors 100 coupled to a bus 105. The bus 105 can be coupled to any of various subsystems including, for example: a temporary memory 110; a secondary memory 112 such as, a disk 114, and/or a removable storage drive 116 into which media 118 can be placed including, e.g., a diskette, a compact diskette (e.g. CD ROM) or the like; an input device such as a mouse 120, or a keyboard 125; an output device such as a display 130 or printer 135; and input/output (I/O) devices to a network 10, for example an network interface card (NIC) 140, such as an Ethernet, Token Ring, Smart or Asynchronous Transfer Mode (ATM) card. Other input/output devices may include a modem 145, or other input/output device such as, a wireless interface 150 (e.g. a wireless transceiver). It will be apparent to those skilled in the relevant art that the above-described workstation 20 has been provided as an example and is not intended to limit the breadth of the invention in any way. The software performing the method steps may be stored on any storage medium, which can be accessed by the workstation 20.

Although it is preferable that all of the images shown in Figures 5-17 be displayed on the display 130, it is understood that displaying each and every step is not necessary. It is further understood that the sculpture shown in the figures is only intended as an example. The designer may design any sculpture. Moreover, the designed electrode may be applied to any mold for any mold process. A dome shaped mold used in a blow-molding process is just one embodiment.

Figure 4 is a flow chart showing an exemplary embodiment of the present invention. Exemplary illustrations of the method steps in the flow chart of Figure 4 are shown in Figures 5-17. In an exemplary embodiment of the present invention, a designer may begin forming the design by generating a two-dimensional, flat image or shape of the artwork, which he or she wishes to appear on the container (step 400). An exemplary view of such an image is shown in Figure 5. As illustrated in Figure 5, the exemplary two-dimensional image 500 may be created with a hole 502

corresponding to the space between the handle 212 and the sidewall 202 of the container 200 to which the design is to be applied. Any other desired features or irregularities can be similarly incorporated into the desired design.

In another exemplary embodiment of the invention, a boundary image may be created on a virtual container. For example, the virtual container of Figure 10 can be created with a virtual container surface 1002, that includes a handle region 216. A designer can then create a boundary image on the virtual container surface 1002 using any of a number of commercially available drawing programs such as, for example, an AutoCAD program, and/or any of the various programs from Delcam noted below. For example, curves may be drawn on the 3D surface such as, e.g., 3D bspline curves. The boundary image, as drawn on the virtual container, can then be projected (or flattened) onto a plane to generate a two dimensional image 500. The two dimensional image 500 created according to this embodiment of the invention may include the hole 502 corresponding to the space between the handle 212 and the sidewall 202 of the container 200 to which the design is to be applied. When created according to this embodiment of the invention, the two dimensional image 500 incorporates the layout of the virtual container, and can simplify later manipulations of the image on the container surface, as described in more detail below.

In a step for forming a virtual sculptural relief image (step 402), as seen in the exemplary illustration of Figures 6-9, the two-dimensional flat image 500 may be transformed into a three-dimensional relief image 600. As shown in Figures 6-9, three-dimensional relief image 600 maintains hole 502 of two-dimensional image 500. The relief image 600 is designed in three dimensions with a particular relief geometry in mind in order to be compatible with the angular aspects of the container. Compare Figures 5-6. However, until the image is projected onto a container and suitably manipulated, it can not be used to create a mold. As shown in Figures 10-14, relief image 600 may be manipulated by, for example, rotating, stretching, or bending the relief image to a position suitable for projecting onto a virtual container.

Steps 400 and 402 may be implemented using commercial software packages such as, for example, ArtCam sold by Delcam plc of Birmingham, England. A sculptural relief is a three-dimensional image formed in an otherwise planar surface.

A sculptural relief may be either positive (protruding from the plane toward an observer) or negative (receding from the plane relative to the observer). A virtual sculptural relief is a graphically created sculptural relief as may be shown on a display. Figures 6-9 are examples of a positive virtual sculptural relief image 600 formed from a two-dimensional, flat image 500 such as the one shown in Figure 5, for example. Alternatively, a virtual sculptural relief image 600 may be created without referencing a two-dimensional image (step 402). Virtual sculptural relief image 600 is stored in memory as digital data. Virtual sculptural relief image 600 may be stored in a digital file format familiar to a tooling shop such as IGES or STL formats, for example.

After the virtual sculptural relief image 600 is formed (step 402), it may be projected onto a simulated or "virtual" container surface 1002 (step 404), as shown in Figure 10. A software application program may be used to take the relief image 600 and to project the image onto the virtual container surface. In an exemplary embodiment of the present invention, software application programs may be used such as, e.g., CopyCAD, ArtCAM PRO, PowerSHAPE, Power Solutions, and PSArt, available from Delcam plc, as noted above, of Birmingham, England. For the purposes of this description, simulated container surface means a virtual surface created on the display of the workstation which has a shape corresponding to the shape of the container surface on which the sculptural relief image 600 is to appear. Figures 10-14 show the sculptural relief image projected onto such a virtual surface 1002. The simulated container surface is not limited to being a container handle, but might extend to any scenario involving multiple surfaces with varying angular aspects relative to each other. Thus, the simulated container surface may be any shape onto which incorporation of a particular sculptural relief is desired.

As illustrated in Figures 10-14, after projecting sculptural relief image 600 onto simulated container surface 1002 (step 404), a method according to an exemplary embodiment of the present invention may include manipulation (step 406), including but not limited, to resizing and/or moving and/or repositioning and/or changing or moving a boundary line of the virtual sculptural relief image 600, relative to container surface 1002. Figure 10, for instance, shows an exemplary sculptured

relief image 600 which has not yet been manipulated to approximately fit, e.g., boundaries of the container. Figure 11 illustrates the exemplary relief after some resizing. Figures 12 to 13 are representations of an exemplary relief which has been resized and rotated enough to almost fit the container, and is being selectively stretched and resized to wrap around the various contours of handle 212 and sidewall 202 of container 200. For example, in progressing from the exemplary structure shown in Figure 12 to the exemplary structure shown in Figure 13, the boundary relief image 600 is selectively extended to wrap into a position corresponding to the contour of the container wall underlying the handle 216. As will be discussed below, Figure 18 shows an exemplary relief which has been fully manipulated to fit the container as designed according to an exemplary embodiment of the present invention.

After the virtual sculptural relief is projected onto the simulated container surface (step 404), and suitably manipulated (step 406), the virtual sculptural relief may be preferably triangulated (step 408) to differentiate the surface of the virtual sculptural relief projected onto the simulated container from the simulated container surface, which does not contain the projected surface of the sculptural relief. In effect, a digital data set is formed defining points of the sculptural relief relative to points defining the surrounding simulated container surface. Triangulation of shapes or images is a well known process, which involves using a plurality of triangles in a coordinate system to define a shape or image. Any other method for ascertaining the surface of the sculptural relief on the simulated mold cavity can be used.

When projecting the virtual sculptural relief onto the virtual container surface, around the hole formed by the handle, for example, distortions in the projected relief may be created by the hole. According to an exemplary embodiment of the present invention, where boundary lines have been distorted, an operator of the graphical software application program may correct the distorted lines of the boundary image, by, e.g., drawing lines on the virtual surface, such as one or more bspline curves, in 3-D on the 3-D surface. The corrected bspline curves may then be projected to a 2D plane in 3D space, flattening the curves. The plane may be at an oblique angle to the surface of the projected relief. The resulting new 2D image may be used to develop a

new virtual sculptural relief. The new virtual sculptural relief, may then be reprojected onto the virtual container surface to obtain the design of the container.

After the surface of the projected sculptural relief on the simulated container is ascertained, the simulated mold cavity surface outside boundary of the projected sculptural relief image may be trimmed away or removed (step 410). Figures 15-17 illustrate an exemplary leaf texture relief image, comparing an exemplary flat relief (a) to an exemplary projected relief (b). The outer boundary of projected sculptural relief image shown in Figures 15-17 determines the profile or outline of the projected sculptural relief image (step 410). Steps 404 through 410 may be performed by commercially available software packages such as CopyCad®, PowerSHAPE, PSArt, Power Solution, and ArtCAM PRO, available from Delcam®.

The resulting boundary or profile (step 410) may provide one or more digital files to a tooling shop in a digital format familiar to the shop such as, for example, IGES or STL files. The digital images created according to an exemplary embodiment of the present invention may be transformed into images for creating a mold. The tooling shop can then use these files to tool the desired image into the mold. Thus, in contrast to conventional methods that may impress a design into an existing mold, an exemplary embodiment of the present invention may use the combination of design software and tooling software to directly tool a pattern into a mold. Using this combination in this way may allow a designer to incorporate features not contemplated nor attainable using conventional methods.

After the tooling shop has made the mold from an image generated through a method according to an exemplary embodiment of the present invention, the mold can be used to make a container having the relief image thereon. The container may be made of a plastic material, such as nylon; polyolefins, such as, e.g., but not limited to, polypropylene, high density polyethylene and low density polyethylene; and polyesters, such as polyethylene terephthalate, for example. The container may be made according to methods known to those skilled in the art such as injection blow-molding, stretch blow-molding, or extrusion blow-molding, for example.

Figure 18 shows a container 1800 comprising sidewall 1802 and handle 1804 having a three-dimensional sculptured image 1806 applied thereon according to an

exemplary embodiment of the present invention. According to an exemplary embodiment of the present invention, handle 1804 creates a hole 1808 between itself and sidewall 1802. Because of hole 1808, image 1806 must be applied at an oblique angle in order to be applied to sidewall 1802 and handle 1804 simultaneously. Although an exemplary leaf design is used to illustrate an exemplary embodiment of the present invention, it will be apparent to those skilled in the art that any image design, or any type of virtual sculptural relief may be used within the scope of the present invention.

While the invention has been described in detail with reference to specific and preferred embodiments, it will be appreciated that various modifications and variations will be apparent to the artisan. All such modifications and embodiments as may occur to one skilled in the art are intended to be within the scope of the appended claims.